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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/686,480	10/16/2003	Katsunori Nishimura	520.43216X00	8057

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EXAMINER	
CHUO, TONY SHENG HSIANG	
ART UNIT	**PAPER NUMBER**
1745	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/21/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/686,480	NISHIMURA ET AL.	
	Examiner	Art Unit	
	Tony Chuo	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-13 and 16-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-13 and 16-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *14 June 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/3/06 has been entered.

Response to Amendment

2. Claims 2-13 and 16-23 are currently pending. Claims 1, 14, and 15 have been cancelled. The previously stated 112, 1st paragraph rejection of claims 17, 18, 22, and 23 is withdrawn. The previously stated 112, 2nd paragraph rejection of claims 17, 22, and 23 is withdrawn. The amended claims 12, 17, 18, and 22 do overcome the previously stated 103 rejections. However, upon further consideration, claims 2-13 and 16-23 are currently rejected under the following new 112 and 103 rejections.

Claim Objections

3. Claim 22 is objected to because of the following informalities: the phrase "and a" in line 2 should be deleted. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear whether the water supplying surface is the surface supplying water to the water retaining layer or the surface supplying water to humidify the oxidizing gas or fuel gas.

6. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear which surface is the opposed surface of the porous member.

7. Claim 11 recites the limitation "said fuel cell assembly of claim 18" in line 4. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 19 recites the limitation "the opposed surface" in line 3. There is insufficient antecedent basis for this limitation in the claim.

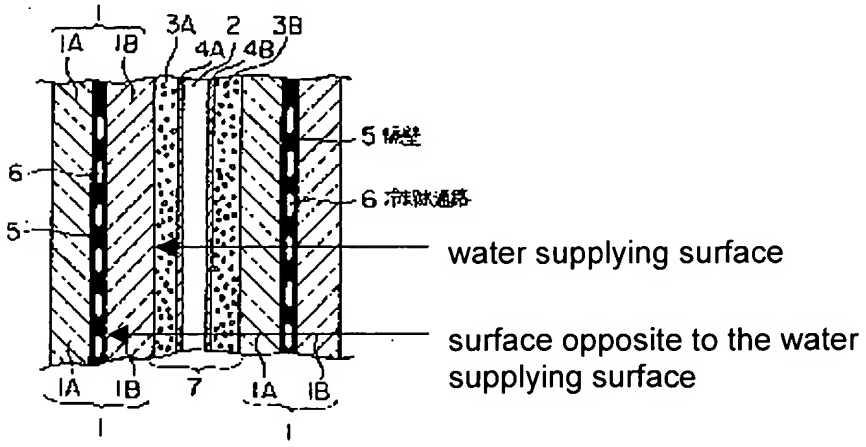
Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 12, 13, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Makihara (JP 07-320753) in view of Yi et al (US 2001/0004501). The Makihara reference discloses a fuel cell comprising a cathode “4B”, an anode “4A”, a

electrolyte membrane "2" in between the cathode and anode, and a gas separator "1" that also functions to humidify the oxidizing gas and the fuel gas (See paragraph [0023],[0024]). It also discloses a gas separator "1" with water retaining layers "1A" & "1B" that have average pore diameters of about 10-100 micrometer whereby water is retained by capillary force by the water retaining layer when the fuel cell is not working and water is taken against the capillary force when the fuel cell is working (See paragraph [0025]). It also discloses a water retaining layer that is a hydrophilic porous body provided opposite to the unit fuel cell "7" that has a water supplying surface wherein water is supplied from part of the surface opposite to the water supplying surface of the porous member (See paragraph [0025] and Figure shown below). Examiner's note: The water supplying surface is construed as being the surface supplying water to humidify the oxidizing gas or fuel gas.



However, Makihara does not expressly teach a water retaining layer that has a thickness of 50 to 300 μm. The Yi reference discloses a hydrophilic substrate layer that has a thickness of about 175 micron that functions as a water retaining layer that humidifies oxidant gas and fuel gas (See paragraph [0066]). Therefore, it would have

been obvious to one of ordinary skill in the art at the time the invention was made to modify the Makihara fuel cell to include a water retaining layer that has a thickness of 50 to 300 μm in order to control the rate of diffusion of water to the reactant gases and to minimize the overall thickness of the fuel cell.

11. Claims 2, 8, 10, 11, and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (US 6649297) in view of Yi et al (US 2001/0004501). The Marchand reference discloses a fuel cell assembly comprising a membrane electrode assembly "84" that inherently comprises a cathode, an anode, and a membrane electrolyte in between the cathode and anode; and a porous plate "90" that functions to provide capillary drainage of the water and/or its distribution and its redistribution, for example for internal humidification of the gases (See column 5, lines 51-53, column 10 line 58 to column 11 line 6, and Figure 9). It also discloses a porous plate "90" that is a water retaining layer wherein the water retaining layer is disposed to face gas flow channels "82" & "83" of the stack to humidify the fuel gas and oxidizing gas (See column 11, lines 3-6 and Figure 9). It also discloses water retained in the porous plate "90" that is supplied to the flow channels from at least one of part of the opposed surface of the porous plate (See Figure 9A). Examiner's note: The opposed surface of the porous member is construed as being the surface of the porous plate facing the gas flow channels. It also discloses two porous plates (water retaining layers) "90" (See Figure 9). It also discloses a humidifier that is provided with each of the unit fuel cells "84" (See Figure 9). Examiner's note: It is implicit that the fuel cell system taught by Marchand et al comprises an apparatus which produces or stores a hydrogen containing gas and a fuel cell assembly connected to the apparatus with a

piping through which fuel gas flows wherein the fuel cell assembly generates electricity using the fuel gas from the apparatus.

However, Marchand et al does not expressly teach a hydrophilic water retaining layer that is made of a hydrophilic polymer material, a carbonaceous porous material, or a composite material that has a mean pore diameter of 10 to 300 μm and a thickness of 50 to 300 μm. The Yi reference discloses a hydrophilic substrate layer "100" comprised of a porous carbon composite that has a thickness of about 175 micron and an average pore size of about 27 microns to 37 microns (See paragraph [0066]). Examiner's note: It is inherent that the hydrophilic substrate layer functions as a water retaining layer that humidifies the oxidant gas and fuel gas as well as a carbonaceous porous filter that controls the rate of water to the hydrophilic substrate layer. Since Yi et al discloses a hydrophilic substrate layer that has the same mean pore diameter and thickness as the applicant's water retaining layer, it is contended that the claimed property of retaining water by capillary force when the fuel cell is not working and distributing water to the oxidizing gas and fuel gas against capillary force when the fuel cell is working is inherent to the material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand fuel cell to include a hydrophilic water retaining layer that is made of a carbonaceous porous material that has a mean pore diameter of 10 to 300 μm and a thickness of 50 to 300 μm in order to maintain proper humidification of the reactant gases by controlling the rate that water is supplied to the reactant gases.

12. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (6649297) in view of Yi et al (US 2001/0004501) as applied to claim 18 above, and further in view of Kawazu (JP 08-138704).

However, Marchand et al as modified by Yi et al does not expressly teach a humidifying water inlet of the humidifier. The Kawazu reference discloses a humidifying water inlet for a humidifier (See Drawing 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand/Yi fuel cell assembly to include a humidifying water inlet of the humidifier in order to ensure that enough water is supplied to the porous plate to properly humidify the reactant gases.

However, Marchand et al as modified by Yi et al and Kawazu does not expressly teach the thickness of a humidifying water inlet of the humidifier that is ½ to ¾ the thickness of the porous member. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand/Yi/Kawazu fuel cell assembly so that the thickness of a humidifying water inlet of humidifier that is ½ to ¾ the thickness of the porous member because changes in proportion were held to be obvious (See Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984)). In addition, there is no evidence of criticality of the claimed ranges for the thickness of the humidifying water inlet.

13. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (6649297) in view of Yi et al (US 2001/0004501) as applied to claim 18 above, and further in view of Kawazu (JP 08-138704). However, Marchand et al as modified by Yi et al does not expressly teach a water permeable membrane that has the function of

transmitting water formed on the porous material of the water retaining layer. The Kawazu reference discloses a humidifier "600" of the fuel cell comprising a porous membrane "602" formed on the water retaining layer "610" (See Drawing 5 and paragraph [0062]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand/Yi fuel cell assembly to include a water permeable membrane that has the function of transmitting water formed on the porous material of the water retaining layer in order to further limit the rate of humidification of the reactant gases so that flooding does not occur in the fuel cell.

14. Claims 5-7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (6649297) in view of Yi et al (US 2001/0004501) and Kawazu (JP 08-138704) as applied to claim 4 above, and further in view of Mossman (US 2001/0046616). However, Marchand et al as modified by Yi et al and Kawazu does not expressly teach that the water permeable membrane has a mean pore diameter of 0.01 to 0.1 micrometer, a thickness of 10 to 100 micrometer, and a porosity of 50-90%. It also does not expressly teach that the membrane is treated to be hydrophilic and selected from polytetrafluoroethylene, polystyrene and copolymer of styrene and butadiene. The Mossman reference discloses a water permeable membrane, Nafion, that is a polytetrafluoroethylene membrane treated to be hydrophilic and has an average pore size between 0.025 to 0.1 micrometer, a porosity of greater than 50%, and a thickness of 89 micrometer (See paragraph [0016] and Dupont Nafion PFSA Membranes Specs). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Kawazu/Yi/Kawazu fuel cell assembly to have a water permeable membrane be a polytetrafluoroethylene

membrane that is treated to be hydrophilic and has an average pore size between 0.025 to 0.1 micrometer, a porosity of greater than 50%, and a thickness of 89 micrometer in order to have a membrane that is effective in adequately humidifying a reactant gas of the fuel cell.

15. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (US 6649297) in view of Yi et al (US 2001/0004501) as applied to claim 18 above, and further in view of Kawazu (JP 08-138705). However, Marchand et al as modified by Yi et al does not expressly teach a porous member that has a hydrogen oxidizing catalyst dispersed therein. The Kawazu reference discloses a hydrogen oxidizing catalyst "22" that is dispersed on the porous film "21" (See Abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand/Yi fuel cell assembly to include a hydrogen oxidizing catalyst that is dispersed on the porous water permeable membrane so that a drop in the power generating capability of the fuel cell can be prevented by preventing drop in humidifying function caused by hydrogen gas passing through the porous membrane.

16. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (US 6649297) in view of Yi et al (US 2001/0004501), and further in view of Kawazu (JP 08-138704). The Marchand reference discloses a fuel cell assembly comprising a membrane electrode assembly "84" that inherently comprises a cathode, an anode, and a membrane electrolyte in between the cathode and anode; and a porous plate "90" that functions to provide capillary drainage of the water and/or its distribution and its redistribution, for example for internal humidification of the gases (See column 5, lines 51-53, column 10 line 58 to column 11 line 6, and Figure 9). It also

discloses a porous plate "90" that is a water retaining layer that has a surface to supply water to the flow channels "82" & "83" (See column 11, lines 3-6 and Figure 9).

However, Marchand et al does not expressly teach a hydrophilic water retaining layer that has a mean pore diameter of 10 to 300 μm and a thickness of 50 to 300 μm. The Yi reference discloses a hydrophilic substrate layer "100" that has a thickness of about 175 micron and an average pore size of about 27 microns to 37 microns (See paragraph [0066]). Examiner's note: The hydrophilic substrate layer functions as a water retaining layer that humidifies the oxidant gas and fuel gas. Since Yi et al discloses a hydrophilic substrate layer that has the same mean pore diameter and thickness as the applicant's water retaining layer, it is contended that the claimed property of retaining water by capillary force when the fuel cell is not working and distributing water to the oxidizing gas and fuel gas against capillary force when the fuel cell is working is inherent to the material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand fuel cell to include a hydrophilic water retaining layer that has a mean pore diameter of 10 to 300 μm and a thickness of 50 to 300 μm in order to maintain proper humidification of the reactant gases by controlling the rate that water is supplied to the reactant gases.

However, Marchand et al as modified by Yi et al does not expressly teach water that is supplied from part of a surface opposite to the water supplying surface and/or from the outer edge of the water retaining layer. The Kawazu reference discloses

supplying water to a surface opposite to the water supplying surface of the water retaining layer "111" (See Drawing 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Marchand/Yi fuel cell assembly to include water that is supplied from part of a surface opposite to the water supplying surface in order to maintain proper humidication of the reactant gases by supplying additional water to the porous plate that is humidifying the reactant gases.

17. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marchand et al (US 6649297) in view of Yi et al (US 2001/0004501) as applied claim 22 above, and further in view of Nakao et al (US 4909810). However, Marchand et al as modified by Yi et al does not expressly teach a water retaining layer that is polypropylene non-woven cloth or polyethylene-propylene non-woven cloth that is made hydrophilic. The Nakao reference teaches a vapor permselective membrane comprising a membrane laminated with a hydrophilic porous material that is a polypropylene non-woven fabric (See column 7, lines 31-40 and 60-61 and column 8, lines 14-15). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Kawazu fuel cell assembly to include a water retaining layer that is polypropylene non-woven cloth in order to provide a membrane with a high water vapor permeation rate that would increase the efficiency of the humidifier to humidify the anode gas.

Response to Arguments

18. Applicant's arguments with respect to claims 2-13 and 16-23 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571) 272-0717. The examiner can normally be reached on M-F, 8:30AM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's trainer, Susy Tsang-Foster can be reached on (571) 272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC

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PRIMARY EXAMINER